

# ENVIRONMENTAL Fact Sheet



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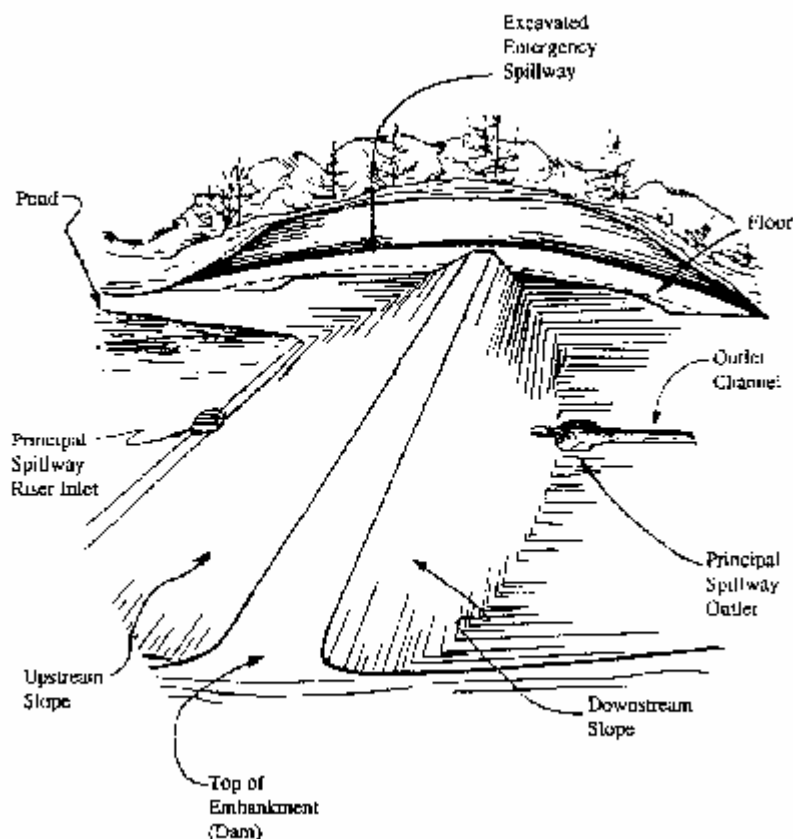
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## Best Management Practices for the Maintenance and Operation of Dams

### Definition

Currently, New Hampshire's statutes state that a dam means any artificial barrier, including appurtenant works that impounds or diverts water, and which has a height of four feet or more, or a storage capacity of two acre-feet or more, or is located at the outlet of a great pond. A roadway culvert shall not be considered a dam if its invert is at the natural bed of the water course, it has adequate discharge capacity, and it does not impound water under normal circumstances. Artificial barriers that create surface impoundments for industrial or commercial wastes, septage or sewage, regardless of height or storage capacity, shall be considered dams. An artificial barrier at a storm water detention basin, which impounds 0.5 acre-foot or less of water during normal conditions, shall not be considered a dam unless its height is 10 feet or greater or its maximum storage is six acre-feet or greater.



## **Elements of a typical embankment dam**

### **Overview**

Whether you are contemplating the construction of a new dam or performing maintenance or operation activities on an existing dam, there are a number of considerations, which, if applied, can improve longevity and performance and reduce the long-term maintenance effort, as well as minimize environmental degradation. Some of these considerations are outlined below.

### **Planning**

The reasons for constructing a dam are many. Current trends indicate that runoff detention, fire protection, aesthetics, wildlife and irrigation are the most frequent reasons cited. When the main purpose of the dam has been set, the next step should be to select a design and location such that the benefits of the dam are maximized and the disturbances to the environment or hazards to downstream inhabitants are minimized. For example, perhaps the best location for a supply pond is at a high point on the property so that gravity feed can be used rather than pumping, or perhaps there is a natural rise in the ground just downstream of a depression thereby minimizing the amount of embankment fill and pond excavation required during construction.

### **Design**

The design is likely the most important element in determining the long-term effectiveness and maintainability of the dam. Here again, the basic purpose for constructing the dam, as well as site factors, will have a large part to do with what the end result should be. Some important site factors relating to the type of dam include location, size, drainage area, existing site conditions and accessibility to the site. The dam should be built with a spillway of sufficient size to pass the flows anticipated from the watershed without causing the dam to be overtopped and damaged/washed away. Also, if the dam's purpose is to provide fire protection to adjacent structures, it should be built in an area with sufficient base flows to keep the pond filled—even during dry periods.

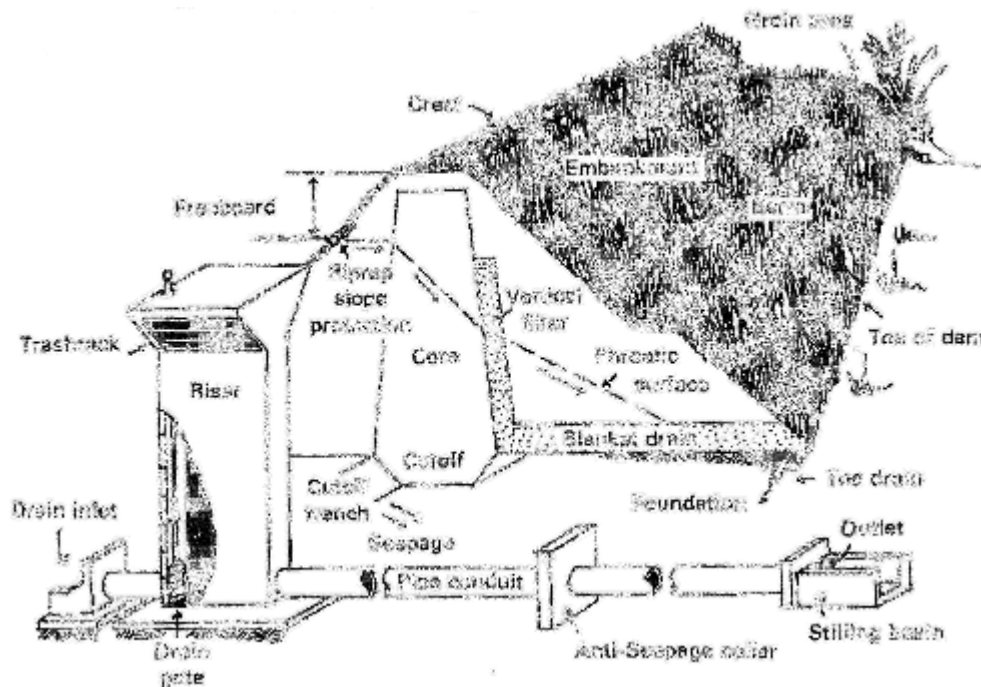
It's important to note that during the planning and design processes, while ensuring that the basic purpose of the dam will be achieved, there may be other factors to consider including compliance with federal, state or local regulations. These regulations could pertain to such things as the design of the dam, emergency planning, environmental impacts or mitigation.

Some general best management practices associated with a dam's design are listed below.

**Discharge capacity.** This should be based on an hydrologic analysis of the drainage area and sufficient to safely pass the flow resulting from the 50 year storm event.

**Embankment slopes.** These should be as flat as possible (no steeper than 3h:1v) for stability and maintenance considerations and covered with an erosion resistant treatment to keep erodible soil in place.

**Embankment crest.** This should be wide enough for a service vehicle, slightly inclined in either direction so as to shed rainfall, and protected by an erosion resistant treatment.



**Cross section of an embankment dam**

**Spillways.** These should be sized to provide the necessary discharge capacity, checked frequently for debris accumulation, stable during use and durable over the long term.

**Low-level outlets.** These should be provided for the purpose of draining the pond, if necessary, and should be easily operable and sized to discharge enough water to drain the pond under most flow conditions.

**Vegetation.** The preferred vegetative cover for embankment crests, slopes and vegetated spillways is any hearty variety of grass. Trees and brushy-type growth are unable to provide the earth retaining characteristics necessary to prevent embankment soil from being washed away.

**Erosion protection.** Where grass cannot be used or where other types of materials are available, coverings such as fractured stone (riprap), keyed stone or other types of durable, well anchored and non-erodible layers can be used as substitutes.

**Trash racks.** These should be provided when drop inlet type spillways are used to prevent larger debris from falling into and clogging outlet pipes.

**Anti-seep collars.** These, when properly attached to low level pipes and coupled with adequate embankment soil compaction, reduce the possibility of seepage along the exterior of the pipes and potential dam failure.

**Freeboard.** This distance between the maximum anticipated water level and the top of the dam should be large enough so that the dam can pass the flow safely and so the action of the wind induced waves cannot cause the dam to be overtopped.

#### **Maintenance**

Even when applying the above management practices it is imperative that periodic visits be made to the dam to ensure that all of its components are functioning properly. There is invariably some degree of maintenance to be carried out at the dam. Anyone with a lawn is aware that without

attention, weeds and bare spots will develop and proliferate. The same is true with the dam embankment. Over time an adjacent wooded area or field will encroach on the dam and require a regime of mowing or brushing-out. As you'll see, your maintenance requirements will be directly based on the location of the dam. If there are a lot of leafy trees overhanging the pond or if beavers live nearby you'll be cleaning up plenty of floating debris from spillways. Whereas if the dam is on a major river or stream, you'll likely be constantly dealing with maintenance items associated with large sustained flows like soil erosion or larger river-borne debris. The activities of beavers are legendary. Although well-meaning, beavers can block a spillway or clog an outlet pipe or even build a dam directly upstream of yours—overnight! Proper maintenance helps to insure that the dam will function as it was intended to. The need for periodic inspection and constant attention to a dam cannot be overstated.

## Operation

As discussed above, planning and designing a dam are thought provoking tasks. With those done and construction complete, maintaining and operating what you've built should be fairly straightforward. Right? Generally, yes. Since most small dams are designed to safely pass a certain amount of flow, usually the 50-year storm event, under normal conditions the dam will operate itself. This will only occur, however, if the proper maintenance discussed above is being carried out.

Operating a dam involves becoming acquainted with how the dam reacts to outside influences. Just like the machine that needs to be warmed up before it runs well, some dams may need to be operated differently in varying weather conditions or in different seasons. Frequent observation of the dam will help you learn its normal routine. Remember, a dam is designed and built to perform a certain way within certain limits. Therefore, it is very important that the original configuration of the dam be maintained. Sometimes things occur that shrink the limits, which may result in the required freeboard of the dam being reduced to something less than what was designed and increasing the risk of overtopping should there be a significant rainfall.

There may also be times when the dam has been designed to pass a certain amount and is being maintained properly but there comes a storm event that produces more flow than the spillway is capable of passing. These types of events usually occur without warning and may lead to damage or failure of dams. At these times, or when overtopping is imminent, it may be necessary to open low level outlets and release water to provide more storage area in the pond or to implement emergency measures such as sandbagging along the crest of the dam. It is strongly recommended that dam owners develop contingency plans and monitor their dams frequently during times of severe weather.

Dam owners should also be aware of the riparian rights of those living downstream. Riparian rights, simply stated, are defined as the rights of a stream bank property owner to have reasonable use of the natural waters. This means that dam owners cannot shut off their dams or divert the stream to another channel and dry up the stream or river. Generally, no special dam operations are necessary to ensure stream flows because base flows are usually high enough to keep water flowing through the spillway. At times of low flow, when evaporation and/or consumption are greater than base flows, water may drop below the invert of the spillway. When this occurs provisions should be made to release some amount of flow through gates, sluices or spillways so that inflow into and out of the pond are balanced.

For more information relative to the design, construction, maintenance and operation of dams, please contact the DES Water Division Dam Bureau at (603) 271-3406 or email [damsafety@des.state.nh.us](mailto:damsafety@des.state.nh.us). General information is available at [www.des.nh.gov/Dam/](http://www.des.nh.gov/Dam/). You may also visit our office at 29 Hazen Drive in Concord, New Hampshire.